Sediment Quality Assessment Survey of the Galveston Bay System



Galveston Bay National Estuary Program GBNEP-30 May 1993

Sediment Quality Assessment Survey of the Galveston Bay System

Sediment Quality Assessment Survey of the Galveston Bay System

Robert Scott Carr, Ph.D. Principal Investigator

U.S. Fish and Wildlife Service National Fisheries Contaminant Research Center Corpus Christi Field Research Station Corpus Christi, Texas

The Galveston Bay National Estuary Program

Publication GBNEP-30 May, 1993

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement # CE-006550-01 to the Texas Water Commission. The contents of this document do not necessarily represent the views of the United States Environmental Protection Agency or the Texas Water Commission, nor do the contents of this document necessarily constitute the views or policy of the Galveston Bay National Estuary Program Management Conference or its members. The information presented is intended to provide background information, including the professional opinion of the authors, for the Management Conference deliberations in drafting of official policy in the Comprehensive Conservation and Management Plan (CCMP). The mention of trade names or commercial products does not in any way constitute an endorsement or recommendation for use.



Policy Committee

The Honorable Rodney Ellis, Chair

Texas Senate

Vice-Chair

Regional Administrator, EPA Region 6

Mr. John Hall

Chair,

Texas Water Commission

Ms. Terry Hershey

Vice-Chair,

Texas Parks and Wildlife Commission

Mr. James Blackburn Founding Chairman,

Galveston Bay Foundation

Mr. Charles W. Jenness

Chair,

Texas Water Development Board

Mr. Charles Miller Past Chairman of the Board Greater Houston Partnership

Local Governments Advisory Committee

The Honorable Ray Holbrook, Chair

Management Committee

Mr. Myron O. Knudson, Chair

Ms. Barbara Britton, Vice-Chair

Scientific/Technical Advisory Committee

Dr. Robert McFarlane, Chair

Ms. Teresa Battenfield, Vice-Chair

Citizen's Advisory Steering Committee

Ms. Sharron Stewart, Chair

Mr. Ron Embry, Vice-Chair

Galveston Bay Public Forum

Dr. Don Bass, Chair

Program Director

Dr. Frank S. Shipley

The Galveston Bay National Estuary Program

Texans increasingly express their expectations for a clean environment in terms of entire ecosystems. Until recently, our tendency was to view environmental problems in isolated pieces we could understand—indeed this view was institutionalized (and seemingly immortalized) in an elaborate mosaic of fragmented jurisdictions. The Galveston Bay National Estuary Program (GBNEP) is a forerunner in elevating hands-on management of coastal environments to the level of the ecosystem; and in doing so, is encouraging an integration of traditionally disparate institutions.

The GBNEP was established under the authority of the Water Quality Act of 1987 to develop a Comprehensive Conservation and Management Plan (CCMP) for Galveston Bay. The purpose of the CCMP is to address threats to the Bay resulting from pollution, development, and overuse. To address these threats, five years of work commenced in 1990, consisting of three phases: (1) Identification of the specific problems facing the Bay; (2) A Bay-wide effort to compile data and information to describe status, trends, and probable causes related to the identified problems; and (3) Creation of the CCMP itself to enhance governance of the Bay at the ecosystem level. The GBNEP is accomplishing this work through a cooperative agreement between the U.S. EPA (Region 6) and the State of Texas (administered by the Texas Water Commission).

The structure of the GBNEP reflects a strong commitment to consensus-building among all Galveston Bay user groups, government agencies, and the public. The GBNEP "Management Conference" consists of six Governor-appointed committees with broad representation, totaling about one hundred individuals. Meetings of these committees are also open to the public, and public participation in policy-setting and in Bay management are considered strengths of the program. When submitted to the Governor of Texas in late 1994, the CCMP will reflect thousands of hours of involvement (much in the form of volunteer time) by individuals who in various ways use, enjoy, or help govern this vital coastal resource.

TABLE OF CONTENTS

		Page
EXECUTIVE	SUMMARY	1
INTRODUCT	TION	2
MATERIALS	AND METHODS	3
Site Selec	tion	3
Field Mea	surements and Sample Collection	4
	Chemistry	9
	Toxicity Testing	10
	l-phase Tests	10
	water Tests	10
	Community Structure Analysis	11
		12
CONTRACTOR	agreements and Comple Collection	12
	surements and Sample Collection	
	and Physical Analyses	12
	Toxicity Testing	13
	l-phase Tests	13
	water Tests	15
Porewater Storage and Extraction Method Comparison Studies		17
Benthic Community Structure Analysis		17
Spearman Correlation Analysis		20
DISCUSSION		20
CONCLUSIONS		28
LITERATUR	E CITED	31
APPENDICE	S	35
	LIST OF TABLES	
Table 1.	Sampling Sites for Galveston Bay Study	5
- 11 A	Contract to the contract of th	
Table 2.	Stations with Excessive Metal Concentrations	
	and Their AVS Normalized Values	14
Γable 3.	Correlation Coefficients for Highly Significant	
	Associations among Physical, Chemical,	
	Biological and Toxicological Data	21
Γable 4.	Effect Levels for Key Contaminants and	
	Stations Exceeding Those Values	23
Table 5.	Station Ranks and Rank Sums of Species Diversity,	
	Morphological Development, Normalized PAHs	
	and Key Metals	26
	ndix 12 Water Quality Measurements on Day 4 of Amphipod	oug A
Table 6.	Summary of Sediment Quality Triad Data	29

TABLE OF CONTENTS-Continued

		Page
	LIST OF FIGURES	
Figure 1.	Location of Sampling Sites in Galveston Bay Study	8
Figure 2.	Sites Exhibiting Significant Toxicity in the Sea Urchin Fertilization and Morphological Development Porewater Assays	16
Figure 3.	Mean Number of Species Per Site in Galveston Bay Study	18
Figure 4.	Mean Shannon-Wiener Species Diversity Indices for Sites in the Galveston Bay Study	19
	LIST OF APPENDICES	
Appendix 1.	Physical Parameters and Location of Collection Stations	37
Appendix 2.	Sediment Moisture, Total Organic Carbon and Grain Size Analysis	39
Appendix 3.	Sediment Chlorinated Hydrocarbon Concentrations	40
Appendix 4.	Sediment Polycyclic Aromatic Hydrocarbon Concentrations	41
Appendix 5.	Quality Control Data for Pesticides and PCBs	46
Appendix 6.	Quality Control Data for PAHs	47
Appendix 7.	Sediment Metal Concentrations	49
Appendix 8.	Sediment AVS and SEM Analysis	53
Appendix 9.	Quality Control Data for Metals	54
Appendix 10.	Survival of <u>Grandidierella japonica</u> in 10 day Solid-Phase Test	55
Appendix 11.	Water Quality Summary at Beginning of Amphipod Solid-Phase Test	56
Appendix 12.	Water Quality Measurements on Day 4 of Amphipod Solid-Phase Test	58

ACKNOWLEDGEMENTS

There are numerous individuals who contributed to this multidisciplinary project. Dr. Cynthia Howard was involved in all aspects of the project from study design, site selection, sample collection and the entire benthic community structure component of the investigation. Will Roach was instrumental in helping to design the study and provided invaluable assistance and guidance throughout the project. Duane Chapman and Jim Biedenbach provided expert technical assistance in the conduct of the toxicity tests, statistical analyses, and report preparation. Dr. Pasquale Roscigno provided GIS data to aid the site selection process. Drs. Terry Wade and Paul Boothe were responsible for the performance of the organic and inorganic sediment chemistry analyses, respectively. The late Maria Castro provided expert graphical assistance. Alice Fussner assisted in sample collection and the conduct of the toxicity tests. The constructive comments of the GBNEP Scientific and Technical Advisory review team, Lori Robertson, and Duane Chapman helped to substantially improve the final report. We are in grateful for the financial assistance provided by the U.S. Fish and Wildlife Service, Clear Lake Office, which allowed the scope of this project to be expanded.